

Solid Waste Bioreactors:

Bioreactor landfills are designed and operated to rapidly transform and degrade organic wastes through the addition of liquid and air to enhance microbiological activity within the landfill. SWANA has defined a bioreactor landfill as “any permitted Subtitle D landfill and landfill cell where liquid or air is injected in a controlled fashion into the waste mass in order to accelerate or enhance biostabilization of the waste.” There are three different types of bioreactors:

1) Aerobic Reactor – Operates by removing leachate from the bottom layer of a landfill cell and re-circulating the leachate into the landfill in a controlled manner. In addition air is injected into the landfill utilizing horizontal or vertical injection points to stimulate aerobic activity and accelerated organic waste stabilization;

2) Anaerobic Reactor – Operates by adding moisture to the waste. Leachate or other moisture sources are circulated through the waste to stimulate anaerobic decomposition. This method of decomposition produces excess amounts of landfill gas, primarily methane, which can be recovered through a methane extraction system to generate energy and reduce greenhouse gas emissions;

3) Hybrid Reactor – Operates utilizing both aerobic and anaerobic decomposition techniques. Typically this type of reactor rapidly degrades organic waste from the upper portions of the landfill and collect landfill gas from the lower sections.

Bioreactor Benefits:

- Biological decomposition and stabilization in 5 to 10 years verse decades in conventional “dry” landfills.
- Lower waste toxicity and mobility due to both aerobic and anaerobic environments.
- Reduced leachate disposal cost
- A 15 to 30 percent gain in landfill in landfill space
- Significant increase of landfill gases, which can be utilized for onsite energy use or sold.
- Reduced post-closure care

Bioreactor Considerations:

- Increase landfill gas emissions
- Increased odors
- Waste stability issues due to the increase in moisture content
- Liner system instabilities
- Surface seeps
- Landfill Fires

Cost Summary:

Bioreactor installation cost can be relatively high initially; however operating a bioreactor landfill can save money by:

- 1) Re-circulating leachate instead of treatment;
- 2) Increased waste densities;
- 3) Increasing air space resulting for biodegradation and increase waste densities.

The cost to install leachate recirculation devices and enhanced landfill gas extraction is approximately \$200 per acre-foot of landfill area. This construction cost maybe reduced by modifying existing horizontal landfill gas extraction lines to leachate re-circulation devices. Studies show the cost savings per ton for waste density increases are approximately \$13 per ton. If RIRRC receives approximately 3000 tons of trash per day; the total daily cost savings could be \$39000 or \$14,000,000 per year.